PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT-KAN0201	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/JP 03/02581	International filing date *(day/month/year)* 05.03.2003	Priority date *(day/month/year)* 23.08.2002
International Patent Classification (IPC) or both national classification and IPC C01G49/06		
Applicant KANTO DENKA KOGYO CO. LTD et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04.04.2003	22.06.2004
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Rhodes, K Telephone No. +49 89 2399-8259

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/JP 03/02581

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-16 as originally filed

Claims, Numbers

1-4 filed with telefax on 07.05.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-4
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-4
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-4
	No:	Claims	

2. Citations and explanations

see separate sheet

The applicant is requested to note that this is the second written communication.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: EP-A-1164581

2. Novelty

Document D1, which is considered to represent the most relevant state of the art, discloses a method for the manufacture of spindle-shaped goethite and hematite particles.

Said goethite particles are formed by the common process of bubbling an oxygen-containing gas through an alkaline, aqueous, ferrous salt solution. A cobalt compound, in an amount of from 0.5 to less than 6 atm%, is added to the solution before commencing the oxidation reaction. When the reaction has proceeded such that 40 to 50% of the Fe^{II} in solution has been oxidised, an aluminium compound is added and again an oxygen containing gas is contacted with the solution to complete oxidation of Fe^{II} to Fe^{III} (paragraph 0023).
The resulting goethite particle has an average major axial diameter of from 0.05 to 0.18 μm, an aspect ratio of more than 6 to less than 10, a Co content of from 0.5 to less than 5 atm%, and an Al content of from 10.5 to less than 18 atm% (paragraph 0018). Furthermore, it can be seen from example 1 that such a particle may have a BET surface area of around 175 m^2/g.

The hematite particles were formed by treating goethite particles, as formed by the process above, with an anti-sintering agent and heat-treating the spindle- shaped particles at a temperature of 650-800°C in a non-reducing atmosphere (paragraph 0024).
The resulting hematite particle has an average major axial diameter of from 0.05 to 0.17 μm, an aspect ratio of more than 6 to less than 10, a Co content of from 0.5 to less than 6 atm%, and an Al content of from 10 to less than 20 atm% (paragraph 0019). Furthermore, it can be seen from example 1 that such a particle

may have a BET surface area of around 43 m^2/g.

D1 describes an iron oxide powder, useful in a magnetic recording layer of a magnetic recording medium, doped with both cobalt and aluminium. As the iron oxide of present claim 1 is cobalt-doped, with no further dopants present, the subject-matter of **claims 1 and 2** is novel over the disclosure of D1 (Article 33(2) PCT).

The process of **claim 3** is novel over D1, as it is not known to add the aqueous cobalt solution subsequent to the oxidation of 50% or more of the Fe^{II}, nor is it known to fire the goethite powder at a temperature of between 400 and 600°C.

Claim 4 relates to the use of a cobalt-doped iron oxide particle as ion oxide powder for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure. As the cobalt-doped iron-oxide of the present application is novel over the prior art, its use must therefore also be novel.

3. Inventive Step

The problem to be solved by the present application can be seen as the provision of a magnetic iron oxide powder containing cobalt which has excellent dispersibility, capability of forming a smooth undercoat layer of coat-type magnetic recording medium, low transmittance, and high electrical conductivity, as well as a process for its production.

The iron oxide powder of D1 differs mainly from that of present claim 1 in that it is both cobalt- and aluminium-doped, yet having the same average length, aspect ratio, BET surface area and cobalt content as specified in claim 1 (see, for instance, examples 2 and 8-11). Furthermore, the present iron oxide is characterised by its coercive force and saturation magnetization properties. Although there are no data provided in the examples for the coercive force or saturation magnetisation of the doped hematite particles of the prior art, it is stated in paragraph 93 of said document that the spindle-shaped magnetic metal particles containing iron as a main component have a coercive force of 111.4 - 143.2 kA/m and a saturation magnetization of 110 - 160 Am^2/kg.

These values differ significantly from the iron oxide powder of present claim 1,

which has a coercive force of 15 - 60 kA/m and a saturation magnetization of 0.2 - 5.0 Am^2/kg

The applicant has shown, by way of examples, that an iron oxide powder having said magnetic properties can be used advantageously for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure. As there is no teaching or suggestion of this in the prior art, **claims 1 and 2** are inventive in the sense of Article 33(3) PCT.

The method of **claim 3** differs mainly from the disclosure of D1 in that the aqueous cobalt solution is only added to the goethite synthesis system when 50 to 100% of the iron(II) has been oxidised to iron(III), instead of being added before the oxidation reaction has begun. Furthermore, the firing of the goethite powder is performed at a temperature of up to 600°C, as opposed to at 650°C as in the prior art method. The product of the presently claimed process differs significantly from the product of the prior art process, particularly in its advantageous magnetic properties, as a result of the differing production procedure. Thus, claim 3 is accorded with an inventive step.

The use of such a cobalt-doped iron oxide powder for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure is considered to be inventive. The spindle-shaped hematite particles of D1 are used in a magnetic recording layer of a magnetic recording medium. There is no suggestion that cobalt-doped magnetic iron oxide particles can be used for the undercoat layer of a coat-type magnetic recording medium. The applicant has shown, by way of examples, that the iron oxide of the present application has properties enabling the satisfactory formation for an undercoat layer, thus rendering **claim 4** inventive.

4. Industrial Applicability

The cobalt-doped iron oxide powder and its method of manufacture are of clear industrial applicability in the magnetic recording industry.

CLAIMS

1. Iron oxide powder for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure which comprises cobalt-doped iron oxide particles having an average length of 0.02 to 0.3 μm, an aspect ratio (length to width ratio) of 2 to 13, and a BET specific surface area of 40 to 100 m^2/g, containing a cobalt compound in an amount of 0.2 to 10 atom% in terms of cobalt based on total iron, and having a coercive force of 15 to 60 kA/m and a saturation magnetization of 0.2 to 5.0 Am^2/kg.

2. Iron oxide powder for an undercoat layer of a coat-type magnetic recording medium according to claim 1, wherein said cobalt-doped iron oxide particles are cobalt-doped α-iron oxide particles.

3. (Amended) A process of producing iron oxide powder for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure, which process comprises the steps of synthesizing goethite, filtering the resulting goethite slurry, washing the filter cake with water, drying the cake, and firing the resulting goethite powder at 400 to 600°C, wherein an aqueous cobalt salt solution is added to the system of synthesizing goethite when 50 to 100% of iron (II) is oxidized to iron (III) in the step of synthesizing goethite, followed by continuation of the oxidation reaction to produce cobalt-doped iron oxide particles having an average length of 0.02 to 0.3 μm, an aspect ratio (length to width ratio) of 2 to 13, and a BET specific surface area of 40 to 100 m^2/g and containing a cobalt compound in an amount of 0.2 to 10 atom% in terms of cobalt based on total iron, and having a coercive force of 15 to 60 kA/m and a saturation magnetization of 0.2 to 5.0 Am^2/kg.

4. A use of cobalt-doped iron oxide particles having an average length of 0.02 to 0.3 μm, an aspect ratio (length to width ratio) of 2 to 13, and a BET specific surface area of 40 to 100 m^2/g and containing a cobalt compound in an amount of 0.2 to 10 atom% in terms of cobalt based on total iron as ion oxide powder for an undercoat layer of a coat-type magnetic recording medium having a multilayer structure.